ALTERNATING-CURRENT GENERATOR FOR VEHICLE

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Abstract

PROBLEM TO BE SOLVED: To provide an alternating-current generator for vehicles which is simple in shape for a cooling air suction window and enables noise to be reduced without degrading cooling capability.
SOLUTION: A front-side housing 4 of an alternator is provided with four main spokes 430 and auxiliary spoke 432 formed in the radial direction and eight diagonal spokes 434, which are positioned between the adjacent main spokes 430 and auxiliary spokes 432 and are formed so that they are slanted at a specified angle with respect to the radial direction. The slant of the diagonal spokes 434 is so set that the direction of the slant is opposite to the direction of the slant of the tip of a cooling fan installed at an end face of a rotor with the direction of the radius positioned at the center. When the cooling fan is rotated, the diagonal spokes 434 and the tip of the cooling fan intersect each other at a large angle.

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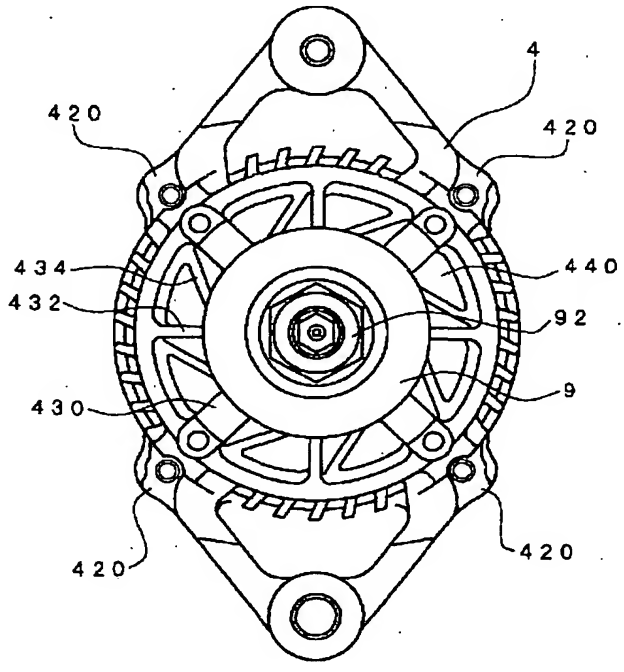
(54)【発明の名称】　車両用交流発電機

(57)【要約】

【課題】　冷却風の吸入窓の形状が単純でしかも冷却性能を低下させることなく低騒音化が可能な車両用交流発電機を提供すること。

【解決手段】　オルタネータ１のフロント側ハウジング４は、径方向に沿って形成された４本の主スポーク４３０および補助スポーク４３２と、隣接する主スポーク４３０と補助スポーク４３２との間であって径方向に対して所定の角度傾斜するように形成された合計８本の斜行スポーク４３４とを有している。斜行スポーク４３４の傾斜方向は、回転子の端面に取り付けられた冷却ファン先端部の傾斜方向に対して、径方向を中心に反対側となるように設定されており、冷却ファンが回転したときに、斜行スポーク４３４と冷却ファン先端部とが大きな角度をもって交差する。



【特許請求の範囲】
【請求項１】　回転軸に固定される界磁鉄心と前記界磁鉄心の軸方向端面に取り付けられる冷却ファンとを有する回転子と、前記回転子を回転可能に支持するハウジングとを備え、少なくとも前記冷却ファンとの対向面が前記回転軸を中心とした径方向に対して傾斜した斜行スポークを前記ハウジングの冷却風の吸入窓に設けることを特徴とする車両用交流発電機。
【請求項２】　請求項１において、
前記斜行スポークの前記対向面での傾斜方向は、前記対向面に近接する前記冷却ファンの傾斜方向に対して、前記径方向を挟んで反対となるように設定されることを特徴とする車両用交流発電機。
【請求項３】　請求項１または２において、
前記ハウジングは、前記径方向に沿った向きに形成された複数の径方向スポークを有しており、円周方向に隣接する前記径方向スポークの間に前記斜行スポークが配置されることを特徴とする車両用交流発電機。
【請求項４】　請求項３において、
前記径方向スポークの少なくとも一部は、固定子締結用のボルトが通る前記ハウジングの支持部に対応していることを特徴とする車両用交流発電機。
【請求項５】　請求項３または４において、
前記径方向スポークで区画された前記吸入窓の対角線に沿って前記斜行スポークを形成することを特徴とする車両用交流発電機。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、冷却ファンを内蔵する車両用交流発電機に関する。
【０００２】
【従来の技術】回転電機の一種である車両用交流発電機は、車両走行中にバッテリの補充電を行うとともに、エンジンの点火、照明、その他の各種電装品の電力を賄うものである。近年、車両の高級化等に伴って、車両用交流発電機の低騒音化が要求されている。
【０００３】ところで、車両用交流発電機の騒音の一つに冷却ファンを回転させたときに発生するファン騒音がある。回転子の軸方向端面に冷却ファンが固定された内扇式の車両用交流発電機においては、この回転子が収納されるフレームの吸入窓近傍においてファン騒音が発生することが知られており、この部分で生じるファン騒音を低減する従来技術としては、実開平３－２１９６４号公報に開示された車両用充電発電機や特開平７－１０７７０４号公報に開示された車両用交流発電機がある。
【０００４】実開平３－２１９６４号公報に開示された車両用充電発電機は、フロント側ハウジング（ブラケット）に形成された吸入窓の形状がハウジングの中心に対し非対称に設定されている。このため、回転子の軸方向端面に取り付けられたファンが回転した場合であっても吸気の周期的な圧力変動が生じにくく、この結果、回転次数比成分の発生を減少させ、吸気に起因するファン騒音を構成する周波数を広く分散させて風騒音の耳障り感を低減させることができ、しかもファン騒音のオーバーオール値も低減させることができる。
【０００５】また、特開平７－１０７７０４号公報に開示された車両用交流発電機は、フロント側ハウジングの吸入窓の外郭形状が四角形形状あるいは多角形形状に形成されている。このため、ファン騒音の次数成分が分散され、ファン騒音低減および不快音低減を図ることができる。
【０００６】
【発明が解決しようとする課題】ところで、上述した実開平３－２１９６４号公報に開示された車両用充電発電機は、フロント側ハウジングの吸入窓の形状がフレームの中心に対して非対称に設定されているため、吸入窓の形状が複雑になって、製品設計およびこれを製造するための型設計が煩雑になって、コスト高になるという問題がある。
【０００７】また、上述した特開平７－１０７７０４号公報に開示された車両用交流発電機は、フロント側ハウジングの吸入窓の外郭形状を多角形に形成しているため、円形に形成する場合に比べると、吸入窓全体の面積が小さくなり、風量が少なくなって冷却性能が低下するという問題があった。このように、上述した従来の車両用交流発電機は、ファン騒音を低減するために吸入窓の形状が複雑になったり、風量が少なくなって冷却性能が低下しており、根本的な解決策とはいえなかった。
【０００８】本発明は、このような点に鑑みて創作されたものであり、その目的は、冷却風の吸入窓の形状が単純でしかも冷却性能を低下させることなく低騒音化が可能な車両用交流発電機を提供することにある。
【０００９】
【課題を解決するための手段】上述した課題を解決するために、本発明の車両用交流発電機は、ハウジングの冷却風の吸入窓に、径方向に対して傾斜した向きを有する斜行スポークが形成されている。このハウジングを界磁鉄心端面に冷却ファンが取り付けられた回転子と組み合わせて用いることにより、冷却ファンが回転してこの斜行スポークと重なる場合に一時的に重複面積が急激に増大することを防止して、冷却ファンが回転したときに生じる圧力変動を低減して低騒音化を図ることができる。また、ハウジングの吸入窓に形成されたスポークの方向を径方向に対して傾斜させただけであるため、吸入窓全体の形状が単純であり、設計や製造が容易となる。また、吸入窓の面積が減少することもないため、冷却性が低下することもない。
【００１０】特に、上述した斜行スポークの傾斜方向は、径方向に対して冷却ファンの傾斜方向と反対になるように設定することが好ましい。互いに反対向きに冷却

ファンと斜行スポークの向きを設定することにより、冷却ファンと斜行スポークのそれぞれの対向部分が垂直に近い角度で交差することになるため重複面積を少なくすることができ、冷却ファンが回転したときに生じる圧力変動をさらに低減することができる。

【００１１】また、上述したハウジングには斜行スポークの他に径方向に沿った径方向スポークが形成されており、円周方向（回転方向）に隣接する径方向スポークの間に斜行スポークを配置することが好ましい。径方向スポークを組み合わせて用いることにより、ハウジングの強度（剛性）を高めることができ、しかも径方向スポークと斜行スポークとが交互に配置されることになるため、冷却ファンとこれらのスポークとの間で生じる圧力変動が不均一化され、ファン騒音の次数成分を分散させてさらなる低騒音化が可能になる。

【００１２】また、上述した径方向スポークの少なくとも一部には、固定子締結用のボルトが通る支持部に対応していることが好ましい。ボルトの締め付け時に発生するハウジングの歪みを少なくすることにより、発電時に固定子の微少振動で発生する磁気的な騒音を低減することができ、車両用交流発電機全体での騒音の発生をさらに抑えることができる。

【００１３】また、径方向スポークと斜行スポークとを組み合わせて用いる場合に、斜行スポークは、径方向スポークで区画された吸入窓の対角線に沿って形成することが好ましい。対角線に沿って形成することにより、傾斜の度合いを大きく設定することができ、冷却ファンと斜行スポークとが交差する角度をさらに大きくして、冷却ファン回転時に生じる圧力変動をさらに低減することができる。また、吸入窓の内周側と外周側を連結するように斜行スポークを形成することになるため、斜行スポークによってある程度の強度を確保することができる。このため、ハウジングの剛性が上がって、固定子の微少振動によって生じる磁気的な騒音を低減することができる。

【００１４】

【発明の実施の形態】本発明を適用した一実施形態の車両用交流発電機（以後、「オルタネータ」と称する）は、ハウジングに設けられた冷却風の吸入窓に、回転子に取り付けられた冷却ファンとは反対向きに傾斜した斜行スポークを形成したことに特徴がある。以下、本発明を適用した一実施形態のオルタネータについて、図面を参照しながら具体的に説明する。

【００１５】図１は、本実施形態のオルタネータの全体構造を示す断面図である。また、図２はフロント側から見た本実施形態のオルタネータの正面図である。これらの図に示すように、オルタネータ１は、回転子２、固定子３、フロント側ハウジング４、リヤ側ハウジング５、ブラシ装置６、整流装置７、電圧調整装置８、プーリ９を含んで構成されている。

【００１６】回転子２は、絶縁処理された銅線を円筒状かつ同心状に巻き回した界磁巻線２１を、それぞれが６個の爪部を有する界磁鉄心２２、２３によって、回転軸２４を通して両側から挟み込んだ構造を有している。また、フロント側（プーリ９側）の界磁鉄心２２の端面には、フロント側から吸い込んだ冷却風を軸方向および径方向に吐き出すために軸流式の冷却ファン２５が溶接等によって取り付け固定されている。同様に、リヤ側の磁極鉄心２３の端面には、リヤ側から吸い込んだ冷却風を径方向に吐き出すために遠心式の冷却ファン２６が溶接等によって取り付けられている。

【００１７】また、回転軸２４のリヤ側には界磁巻線２１の両端に電気的に接続されたスリップリング２７、２８が形成されており、ブラシ装置６内のブラシ６１、６２をスリップリング２７、２８のそれぞれに押し当てた状態で組み付けることにより、整流装置７から界磁巻線２１に対して励磁電流が流れるようになっている。固定子３は、固定子コア３１に形成された複数個のスロットに、３相の固定子巻線３２が所定の間隔で巻き回されている。

【００１８】整流装置７は、３相の固定子巻線３２の出力電圧である３相交流を整流して直流出力を得るためのものであり、所定の間隔で固定される正極側放熱板および負極側放熱板と、それぞれの放熱板に半田付け等によって取り付けられた複数個の整流素子とを含んで構成されている。フロント側ハウジング４およびリヤ側ハウジング５は，上述した回転子２および固定子３を収納しており、回転子２が回転軸２４を中心に回転可能な状態で支持されているとともに、回転子２の界磁鉄心２２、２３の外側に所定の隙間を介して配置された固定子３が固定されている。この固定子３の固定は、円周方向に等間隔に設けられた４箇所の支持部４２０にボルト３４を通して締め付けることにより行われる。フロント側ハウジング４詳細形状については後述する。

【００１９】電圧調整装置８は、界磁巻線２１に流す励磁電流を制御することによりオルタネータ１の出力電圧を調整するためのものであり、負荷が軽くて出力電圧が高くなる場合には、界磁巻線２１に対する電圧の印加を断続することにより、オルタネータ１の出力電圧を所定値に維持する。プーリ９は、エンジン（図示せず）の回転をオルタネータ１内の回転子２に伝えるためのものであり、回転軸２４の一方端（スリップリング２７等と反対側）にナット９１によって締め付け固定されている。また、ブラシ装置６、整流装置７および電圧調整装置８を覆うようにリヤカバー９２が取り付けられている。

【００２０】上述した構造を有するオルタネータ１は、ベルト等を介してプーリ９にエンジンからの回転が伝えられると回転子２が所定方向に回転する。界磁巻線２１に外部から励磁電圧を印加することにより界磁鉄心２２、２３のそれぞれの爪部が励磁され、固定子巻線３２

に３相交流電圧を発生させることができ、整流装置７の出力端子からは所定の直流電流が取り出される。以後、オルタネータ１自身の出力電圧が電圧調整装置８を介して界磁巻線２１に印加されるため、外部から印加する励磁電圧が不要となる。

【００２１】また、上述した回転子２の回転に伴って、一方の界磁鉄心２２の端面に取り付けられた冷却ファン２５が回転するため、プーリ９側に設けられたフロント側ハウジング４の吸入窓４４０を介して冷却風がオルタネータ１内部に吸入され、この冷却風の軸方向成分によって界磁巻線２１が冷却されるとともに、径方向成分によって固定子巻線３２の前方端部が冷却される。同様に、他方の界磁鉄心２３の端面に取り付けられた冷却ファン２６も回転するため、リヤカバー９２の吸入窓を介して吸入された冷却風が、整流装置７あるいは電圧調整装置８を冷却した後に、リヤ側ハウジング５の吸入窓を介して冷却ファン２６まで導かれ、この冷却風が径方向に排出されるため、固定子巻線３２の後方端部が冷却される。

【００２２】図３は、フロント側ハウジング４のみを抜き出してその正面図を示したものである。フロント側ハウジング４は、プーリ９に対向する位置にベアリング３６を収納するベアリングボックス４００と、オルタネータ１をエンジンブロック（図示せず）に取り付けるために使用される２本のステー４１０、４１２と、これらのステー４１０、４１２のそれぞれの根元部分近傍であって側面に等間隔に配置された４つの支持部４２０とを有している。各支持部４２０は、内周面に雌ネジ溝が形成されたボルト収納部を有しており、フロント側ハウジング４内に固定子３を収納した状態で、各支持部４２０のボルト収納部にボルト３４を通して締め付けることにより、固定子３がフロント側ハウジング４に固定される。

【００２３】また、フロント側ハウジング４は、４つの支持部４２０のそれぞれとベアリングボックス４００の外周面とを連結するように径方向に延びた４本の主スポーク４３０と、円周方向に隣接する２本の主スポーク４３０のほぼ中央であって径方向に延びた４本の補助スポーク４３２と、円周方向に隣接する主スポーク４３０と補助スポーク４３２との間であって径方向に対して所定の傾斜角度αを有する向きに形成された合計８本の斜行スポーク４３４とを有している。これらの主スポーク４３０、補助スポーク４３２、斜行スポーク４３４によって区画される空間が冷却風の吸入窓４４０として使用される。

【００２４】図４は、吸入窓４４０近傍の拡大図である。同図に示すように、斜行スポーク４３４は、主スポーク４３０とこれに隣接する補助スポーク４３２とを対向する２辺として区画されたほぼ四角形形状の吸入窓に、径方向に対して傾斜角度αとなるように形成されている。但し、この傾斜方向はこの斜行スポーク４３４に近接する側の冷却ファン２５先端部の傾斜方向と反対になるようにする必要がある。冷却ファン２５と斜行スポーク４３４とが対向する部分に着目した場合に、冷却ファン２５先端部の傾斜方向は、外周側にいくにしたがって回転方向に対して後退するようにその傾斜角度βが設定される。これに対し、斜行スポーク４３４の傾斜方向は、外周側にいくにしたがって回転方向に対して前進するように、すなわち径方向を挟んで冷却ファン２５先端部の傾斜方向と反対になるように傾斜角度αが設定される。

【００２５】また、斜行スポーク４３４の傾斜角度αは、２５°～６５°の範囲に含まれるように設定することが好ましい。斜行スポーク４３４は、冷却ファン２５先端部分とほぼ直角に交わる方が好ましいが、斜行スポーク４３４の傾斜角度αを極端に小さくあるいは大きく設定すると、斜行スポーク４３４と主スポーク４３０とで挟まれた吸入窓４４０Ａおよび斜行スポーク４３４と補助スポーク４３２とで挟まれた吸入窓４４０Ｂの各面積に大きな偏りが生じ、吸入抵抗の増大や異物混入の点から好ましくない。

【００２６】また、強度に着目すると、斜行スポーク４３４は、ベアリングボックス４００の外周面４５０と、この外周面４５０に対向する周方向壁面４５２を連結するように形成することが好ましい。しかも、上述したように吸入窓４４０Ａ、４４０Ｂの面積の偏りをできるだけ少なくするためには、主スポーク４３０とこれに隣接する補助スポーク４３２とを対向する２辺として区画されたほぼ四角形形状の吸入窓の対角線に沿うように斜行スポーク４３４を形成することが好ましい。このような位置に斜行スポーク４３４を形成することにより、フロント側ハウジング４全体の剛性を高めることができる。なお、主スポーク４３０と補助スポーク４３２によってフロント側ハウジング４に充分な剛性を持たせることができる場合には、斜行スポーク４３４の一方端が主スポーク４３０あるいは補助スポーク４３２の途中位置と交差するように斜行スポーク４３４を形成するようにしてもよい。

【００２７】また、図５は図４のＶ－Ｖ線断面図である。図５に示すように、主スポーク４３０、補助スポーク４３２、斜行スポーク４３４は、フロント側ハウジング４の内周面がほぼ同一面となるように設定されている。各スポークの内周面を冷却ファン２５の先端部分に近づけることにより、冷却風の吸入抵抗を少なくすることができる。また、主スポーク４３０、補助スポーク４３２、斜行スポーク４３４のそれぞれの軸方向高さは、主スポーク４３０、補助スポーク４３２、斜行スポーク４３４の順で低くなるように設定されている。フロント側ハウジング４の剛性を高めるためには、主スポーク４３０の断面積を増すことが最も有効であるが、吸入窓４４０Ａ、４４０Ｂの面積を確保することも考慮して、主

スポーク４３０の軸方向高さが最も高く設定されている。また、フロント側ハウジング４の剛性を高めるために次に有効なのは、補助スポーク４３２の断面積を増すことであるため、主スポーク４３０の次に補助スポーク４３２の軸方向高さが高くなるように設定されている。したがって、斜行スポーク４３４の軸方向高さは、最も低くなるように設定される。このように、剛性アップへの寄与の度合いが少ないスポークの高さを低く設定することにより、できるだけ冷却風の通風抵抗を低減することができる。

【００２８】上述したように本実施形態のオルタネータ１は、界磁鉄心２２の端面に冷却ファン２５が取り付けられた回転子２を備えており、この回転子２を回転可能に支持するフロント側ハウジング４の吸入窓４４０に斜行スポーク４３４が形成されている。径方向に対して所定の傾斜角度を有する斜行スポーク４３０が形成されているため、回転子２とともに冷却ファン２５が回転した際に、冷却ファン２５の先端部分と斜行スポーク４３４とが同時に重なる面積を少なくすることができ、冷却ファン２５の回転によって生じる圧力変動を低減することができる。

【００２９】図６は、斜行スポークを用いた場合の圧力変動を示す図である。同図において、横軸は冷却ファン２５を回転させた場合の回転方向に沿った位置を示しており、「Ａ」および「Ｃ」が斜行スポーク４３４が形成された位置に対応し、「Ｂ」がその間の補助スポーク４３２が形成された位置に対応している。また、縦軸は、冷却ファン２５の先端部分近傍の圧力を示している。なお、斜行スポーク４３４が形成された本実施形態のフロント側ハウジング４を用いた場合の圧力変動を実線で示すとともに、比較のために、本実施形態の斜行スポーク４３４を補助スポーク４３２に置き換えた従来型のフロント側ハウジングを用いた場合の圧力変動を点線で示した。

【００３０】斜行スポーク４３４と冷却ファン２５の先端部分とが重なる場合には、これらが所定の角度をもって交差するため重複部分の面積が小さくなって、瞬間的な圧力の上昇を抑えることができる。但し、斜行スポーク４３４の代わりに補助スポーク４３２を用いた場合に比べて、広範囲にわたって冷却ファン２５の先端部分と斜行スポーク４３４とが交差することになるため、圧力が高くなる範囲は広くなる。

【００３１】このように、斜行スポーク４３４が形成されたフロント側ハウジング４を用いることにより、冷却ファン２５を回転させた際の圧力変動を抑えることができるとともに、斜行スポーク４３４の位置における圧力と主スポーク４３０や補助スポーク４３２の位置における圧力とを異ならせて圧力変動の不均一化を図り、冷却ファン２５によって生じるファン騒音の次数成分を下げることができ、ファン騒音の低騒音化を図ることができる。

【００３２】図７は、斜行スポークを用いた本実施形態のオルタネータ１のファン騒音を測定した結果を示す図である。同図において、横軸はオルタネータ回転数を、縦軸はｄＢ単位で表したファン騒音をそれぞれ示している。測定は、全ての次数成分を含む「オーバーオール」と各次数成分の包絡線を示す「次数包絡」のそれぞれについて行った。なお、斜行スポーク４３４が形成された本実施形態のフロント側ハウジング４を用いた場合の測定結果を実線で示すとともに、比較のために、斜行スポーク４３４を補助スポーク４３２に置き換えた従来型のフロント側ハウジングを用いた場合の測定結果を点線で示した。

【００３３】図７に示すように、比較的高い回転数においてファン騒音低減の効果が確認された。特に、「次数包絡」については高回転域の所定範囲において大幅なファン騒音の低減が実現された。これは、主スポーク４３０や補助スポーク４３２の間に斜行スポーク４３４を配置したために圧力変動が不均一化し、次数成分が分散されたためであると考えられる。

【００３４】ところで、上述した斜行スポーク４３４は、径方向に対して一定の傾斜角度αを有するように直線状に形成されているが、途中で傾斜方向を変えて「くの字」型に形成するようにしてもよい。図８は、斜行スポークをくの字型に形成した変形例を示す図である。同図に示すフロント側ハウジング４Ａは、図３に示したフロント側ハウジング４に対して斜行スポークの形状を変更した点が異なっている。斜行スポーク４３４Ａは、径方向に対する２段階の傾斜角度が設定されており、固定子の回転方向に対して後退する側に隣接する吸気窓４４０Ｃに突出させることにより、この斜行スポーク４３４Ａに隣接する２つの吸気窓４４０Ｃ、４４０Ｄの面積がほぼ同じになるように設定されている。

【００３５】このように、斜行スポーク４３４Ａの傾斜方向を２段階に設定してその形状をくの字型とすることにより、吸入窓４４０Ｃ、４４０Ｄの面積の偏りをなくすことができ、一方の面積が極端に小さくなる場合に比べて吸入抵抗の低減を図ることができる。また、吸入窓４４０Ｃ、４４０Ｄの面積が均一化されることにより、侵入可能な異物の大きさが小さくなるため、異物の排除能力を高めることができる。

【００３６】また、上述した斜行スポーク４３４、４３４Ａは、径方向に対して所定の角度を有し、軸方向については回転軸２４と平行になるように形成されていたが、軸方向についても傾斜を付けるようにしてもよい。図９は、斜行スポークを軸方向に対して傾斜させた変形例を示す図であり、斜行スポーク近傍の部分的な拡大図が示されている。また、図１０は図９のＸ－Ｘ線断面図である。

【００３７】図９および図１０に示すように、斜行スポ

ーク４３４Ｂは、軸方向に対して所定角度傾斜しており、冷却ファン２５との対向面から遠ざかるにしたがって、回転方向に対して後退する向きに傾斜している。一般に、回転子２を回転させたときに吸入される冷却風は、この斜行スポーク４３４Ｂの傾斜方向と同じ向きに流れることが知られている。すなわち、冷却風の吸入方向に合わせて斜行スポーク４３４Ｂの軸方向に対する傾斜方向を決めることにより、斜行スポーク４３４Ｂが存在することによる吸入抵抗の増大を極力低減することができ、冷却性能の低下を防止することができる。

【００３８】なお、本発明は上記実施形態に限定されるものではなく、本発明の要旨の範囲内で種々の変形実施が可能である。例えば、図８に示したフロント側ハウジング４Ａに含まれる斜行スポーク４３４Ａは、途中で１回折り曲げてくの字型に形成したが、２回以上折り曲げたり、全体を滑らかな曲線形状に形成するようにしてもよい。また、図９に部分的に示したフロント側ハウジングでは、斜行スポーク４３４Ｂのみを軸方向に対して傾斜させたが、主スポーク４３０や補助スポーク４３２についても同様に軸方向に対して傾斜させてもよい。

【００３９】また、上述した各実施形態のフロント側ハウジングに含まれる斜行スポーク４３４、４３４Ａ、４３４Ｂは、冷却ファン２５と対向する部分と、これと反対にプーリ９側に近接する部分とがほぼ同じ形状に形成されているが、ファン騒音を低減するために特に必要なのは冷却ファン２５に対向する部分の形状等であるため、それ以外の部分の形状等については適宜変更が可能である。例えば、プーリ９側に接近するにしたがって径方向に近づくように、斜行スポーク４３４等を軸方向に沿ってねじるようにしてもよい。

【００４０】また、上述した各実施形態では、フロント側ハウジング４の吸気窓に斜行スポークを形成する場合を説明したが、リヤ側ハウジング５の吸気窓にスポークを形成する場合にも本発明を適用することができる。

【図面の簡単な説明】

【図１】本実施形態のオルタネータの全体構造を示す断面図である。

【図２】図１に示したオルタネータの正面図である。

【図３】フロント側ハウジングの正面図である。

【図４】フロント側ハウジングの吸入窓近傍の拡大図である。

【図５】図４のＶ－Ｖ線断面図である。

【図６】斜行スポークを用いた場合の圧力変動を示す図である。

【図７】斜行スポークを有するフロント側ハウジングが含まれるオルタネータのファン騒音の測定結果を示す図である。

【図８】斜行スポークをくの字型に形成した変形例を示す図である。

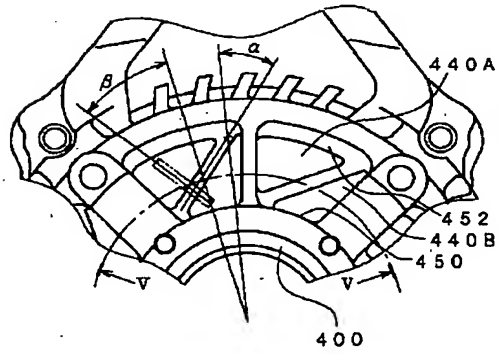
【図９】斜行スポークを軸方向に対して傾斜させた変形例を示す図である。

【図１０】図９のＸ－Ｘ線断面図である。

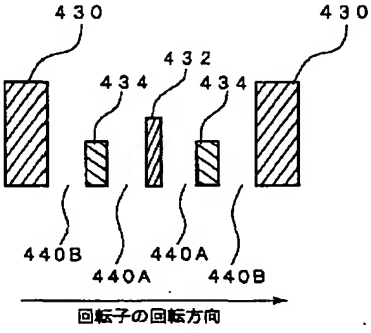
【符号の説明】

１　オルタネータ
２　回転子
３　固定子
４　フロント側ハウジング
５　リヤ側ハウジング
２２、２３　界磁鉄心
２４　回転軸
２５、２６　冷却ファン
４３０　主スポーク
４３２　補助スポーク
４３４　斜行スポーク
４４０　吸入窓

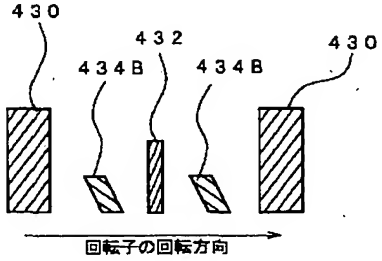
【図４】



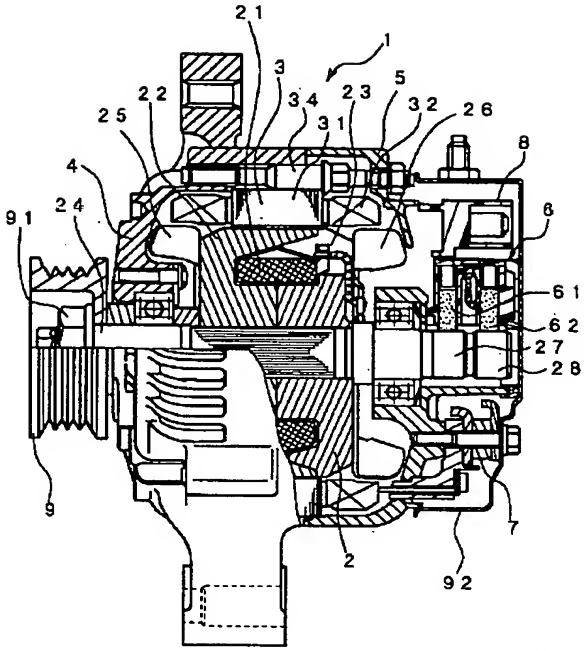
【図５】



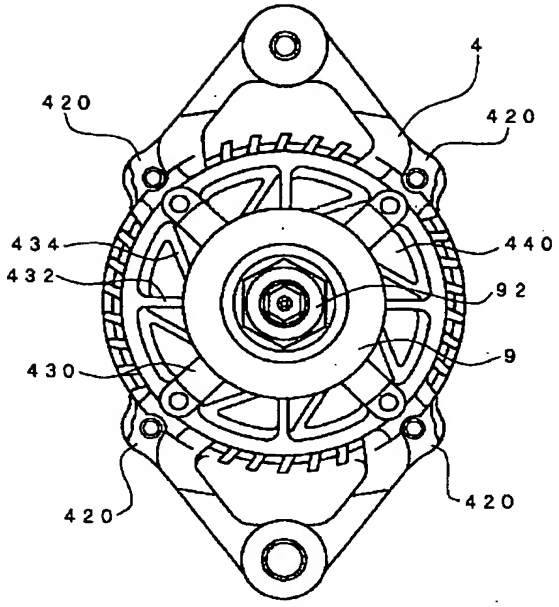
【図１０】



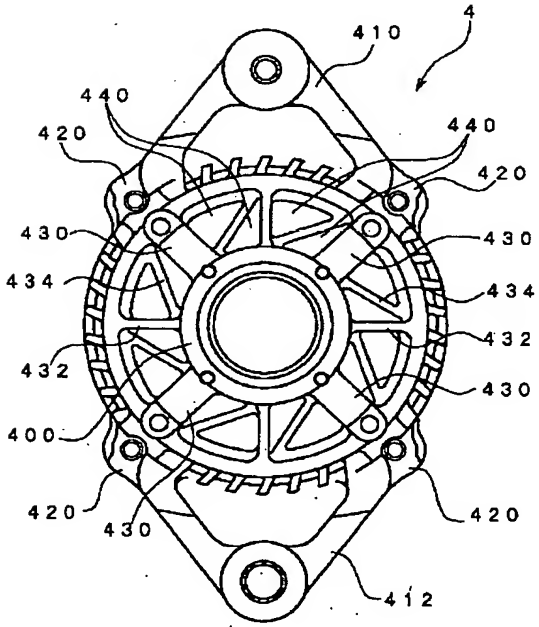
【図１】


21
1
3
34
23
5
32
26
25
22
31
8
4
24
6
91
61
62
27
28
9
7
2
92

【図２】


4
420
420
434
440
432
92
9
430
420
420

【図３】


4
410
440
440
420
420
430
430
434
434
432
432
430
400
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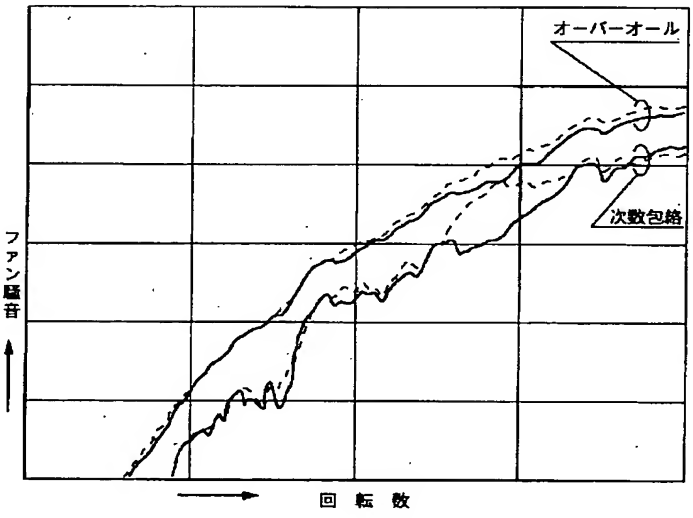
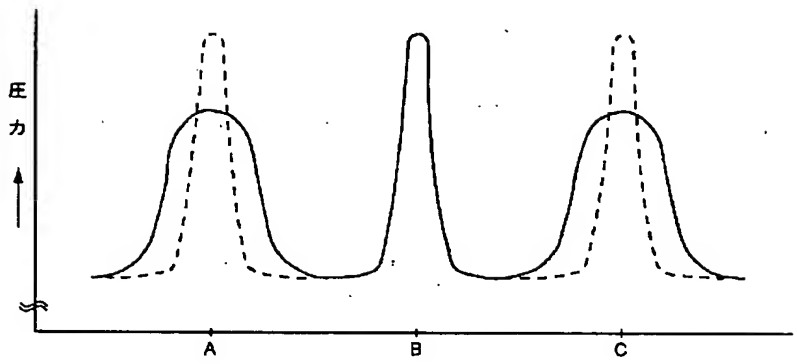
420
430
412

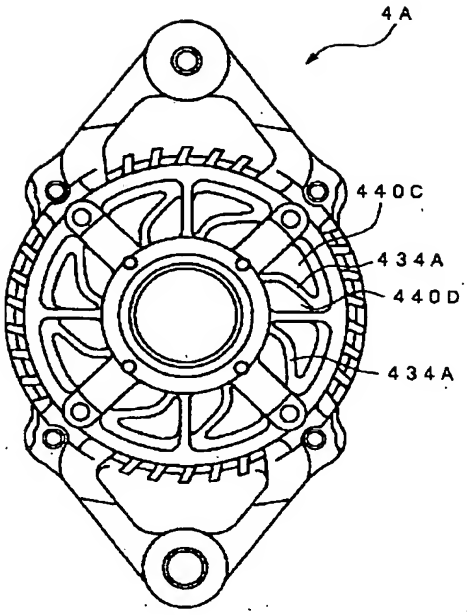
【図７】


オーバーオール
次数包絡
ファン騒音
回転数

【図６】



【図８】



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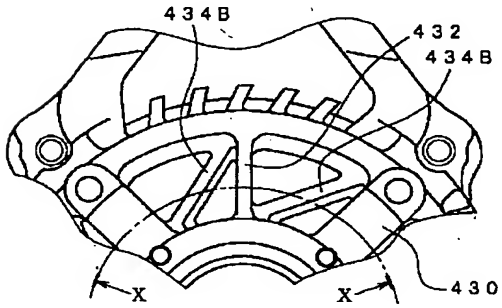

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CLAIMS

[Claim(s)]
[Claim 1] The AC generator for vehicles characterized by preparing the skew spoke toward which it had the rotator which has the cooling fan attached in the shaft-orientations end face of a field core and the aforementioned field core fixed to the axis of rotation, and housing supported possible [rotation of the aforementioned rotator], and the opposed face with the aforementioned cooling fan inclined to the direction of a path centering on the aforementioned axis of rotation at least in the inhalation aperture of the cooling style of the aforementioned housing.
[Claim 2] It is the AC generator for vehicles characterized by being set up so that it may become opposite across the aforementioned path direction to the inclination direction of the aforementioned cooling fan with which the inclination direction in the aforementioned opposed face of the aforementioned skew spoke approaches the aforementioned opposed face in a claim 1.
[Claim 3] It is the AC generator for vehicles characterized by arranging the aforementioned skew spoke between the aforementioned direction spokes of a path which have two or more direction spokes of a path formed in the sense to which the aforementioned housing met in the aforementioned path direction in claims 1 or 2, and adjoin a circumferencial direction.
[Claim 4] It is the AC generator for vehicles characterized by corresponding to the supporter of the aforementioned housing with which the bolt for stator conclusion passes along a part of aforementioned direction spoke [at least] of a path in a claim 3.
[Claim 5] The AC generator for vehicles characterized by forming the aforementioned skew spoke in claims 3 or 4 along with the diagonal line of the aforementioned inhalation aperture divided by the aforementioned direction spoke of a path.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the AC generator for vehicles having a cooling fan.
[0002]
[Description of the Prior Art] The AC generator for vehicles which is a kind of rotation electrical machinery provides the power of ignition in an engine, lighting, and other various electronic autoparts while performing the supplementary current of a battery during a vehicles run. In recent years, low noise-ization of the AC generator for vehicles is demanded with upgrading of vehicles etc.
[0003] By the way, there is fan noise generated when one of the noise of the AC generator for vehicles is made to rotate a cooling fan. It is known that fan noise will occur [near / where this rotator is contained / the inhalation aperture of a frame], and there is an AC generator for vehicles indicated by the charging generator for vehicles indicated by JP,3-21964,U and JP,7-107704,A as conventional technology reduce the fan noise made in this portion in the AC generator of an inner fan type for vehicles with which the cooling fan was fixed to the shaft-orientations end face of a rotator.
[0004] The configuration of an inhalation aperture where the charging generator for vehicles indicated by JP,3-21964,U was formed in front side housing (bracket) is asymmetrically set up to the center of housing. For this reason, even if it is the case where the fan attached in the shaft-orientations end face of a rotator rotates, it is hard to produce the periodic pressure fluctuation of inhalation of air, consequently generating of a rotation degree ratio component is decreased, the frequency which constitutes the fan noise resulting from inhalation of air can be distributed widely, the jarring feeling of a wind noise can be reduced, and, moreover, the overalls value of fan noise can also be reduced.
[0005] Moreover, as for the AC generator for vehicles indicated by JP,7-107704,A, the outline configuration of the inhalation aperture of front side housing is formed in the square configuration or the polygon configuration. For this reason, the degree component of fan noise is distributed and a fan noise reduction and unpleasant sound reduction can be aimed at.
[0006]
[Problem(s) to be Solved by the Invention] By the way, since the configuration of the inhalation aperture of front side housing is asymmetrically set up to the center of a frame, the charging generator for vehicles indicated by JP,3-21964,U mentioned above has the problem that the configuration of an inhalation aperture becomes complicated, and the die design for manufacturing a product design and this becomes complicated, and becomes cost quantity.
[0007] Moreover, since the AC generator for vehicles indicated by JP,7-107704,A mentioned above formed the outline configuration of the inhalation aperture of front side housing in a polygon, when forming circularly, the area of the whole inhalation aperture became small, and it had the problem that air capacity decreased and a cooling performance fell. Thus, in order to reduce fan noise, the configuration of an inhalation aperture became complicated, or air capacity decreased, the cooling performance was falling, and the conventional AC generator for vehicles mentioned above was not able

to say it as a fundamental solution.
[0008] It is created in view of such a point, and the purpose has the simple configuration of the inhalation aperture of the cooling style, and this invention has it in offering the AC generator for vehicles in which the reduction in noise is possible, without moreover reducing a cooling performance.
[0009]
[Means for Solving the Problem] In order to solve the technical problem mentioned above, the skew spoke which has the sense toward which the AC generator for vehicles of this invention inclined to the direction of a path in the inhalation aperture of the cooling style of housing is formed. The pressure fluctuation produced when a cooling fan rotates and it laps with this skew spoke by using this housing for a field core end face combining the rotator attached in the cooling fan, and it prevents that duplication area increases rapidly temporarily and a cooling fan rotates can be reduced, and low noise-ization can be attained. Moreover, since the direction of the spoke formed in the inhalation aperture of housing was made to only incline to the direction of a path, the configuration of the whole inhalation aperture is simple and a design and manufacture become easy. Moreover, in order that the area of an inhalation aperture may not decrease, cooling nature does not fall.
[0010] As for especially the inclination direction of the skew spoke mentioned above, it is desirable to set up so that it may become the inclination direction of a cooling fan and reversely to the direction of a path. By setting the sense of a cooling fan and a skew spoke as the reverse sense mutually, the pressure fluctuation produced when duplication area can be lessened and a cooling fan rotates, since each opposite portion of a cooling fan and a skew spoke will cross at a perpendicularly near angle can be reduced further.
[0011] Moreover, the direction spoke of a path which met in the direction of a path other than a skew spoke is formed in housing mentioned above, and it is desirable to arrange a skew spoke between the direction spokes of a path which adjoin a circumferencial direction (hand of cut). Since the intensity (rigidity) of housing can be raised and the direction spoke of a path and a skew spoke will moreover be arranged by turns by using combining the direction spoke of a path, pressure fluctuation produced between cooling fans and these spokes is ununiformity-ized, the degree component of fan noise is distributed, and the further low noise-ization is attained.
[0012] Moreover, it is desirable to deal with the supporter along which the bolt for stator conclusion passes to a part of direction spoke [at least] of a path mentioned above. By lessening distortion of housing generated at the time of bolting of a bolt, at the time of power generation, a magnetic noise generated in very small vibration of a stator can be reduced, and generating of the noise in the whole AC generator for vehicles can be suppressed further.
[0013] Moreover, when using combining the direction spoke of a path, and a skew spoke, as for a skew spoke, it is desirable to form along with the diagonal line of the inhalation aperture divided by the direction spoke of a path. By forming along with the diagonal line, the degree of an inclination can be set up greatly, the angle which a cooling fan and a skew spoke intersect can be enlarged further, and the pressure fluctuation produced at the time of cooling-fan rotation can be reduced further. Moreover, since a skew spoke will be formed so that an inner circumference [of an inhalation aperture] and periphery side may be connected, a certain amount of intensity is securable with a skew spoke. For this reason, the rigidity of housing can go up and a magnetic noise made by very small vibration of a stator can be reduced.
[0014]
[Embodiments of the Invention] The AC generator for vehicles of 1 operation gestalt which applied this invention (a "AC dynamo" is called henceforth) has the feature in having formed the skew spoke which inclined in the reverse sense with the cooling fan attached in the rotator at the inhalation aperture of the cooling style prepared in housing. Hereafter, the AC dynamo of 1 operation gestalt which applied this invention is explained concretely, referring to a drawing.
[0015] Drawing 1 is the cross section showing the whole AC-dynamo structure of this operation gestalt. Moreover, drawing 2 is the front view of the AC dynamo of this operation gestalt seen from the front side. As shown in these drawings, AC dynamo 1 is constituted including a rotator 2, a stator 3, the front

side housing 4, the rear ** housing 5, brush equipment 6, a rectifier 7, voltage adjustment equipment 8, and the pulley 9.

[0016] The rotator 2 has the structure between which each put the field winding 21 which coiled about the copper wire by which insulating processing was carried out the shape of a cylinder, and in the shape of the said heart from both sides through the axis of rotation 24 by the field cores 22 and 23 which have six claw parts. Moreover, in order to breathe out the cooling wind absorbed from the front side in shaft orientations and the direction of a path, the cooling fan 25 of an axial flow formula is being attached and fixed to the end face of the field core 22 by the side of a front (pulley 9 side) by welding etc. Similarly, in order to breathe out the cooling wind absorbed from rear ** in the direction of a path, the cooling fan 26 of a centrifugal type is attached in the end face of the magnetic pole iron core 23 of rear ** by welding etc.

[0017] Moreover, the slip rings 27 and 28 connected electrically are formed in the ends of a field winding 21 at rear ** of the axis of rotation 24, and an exciting current flows from a rectifier 7 to a field winding 21 by attaching, where the brushes 61 and 62 in brush equipment 6 are pressed against each of the slip rings 27 and 28. A stator 3 is wound about around two or more slots formed in the stator core 31 an interval predetermined in the stator winding 32 of a three phase circuit.

[0018] A rectifier 7 is for rectifying the three-phase-circuit alternating current which is the output voltage of the stator winding 32 of a three phase circuit, and obtaining dc output, and is constituted including the positive-electrode side heat sink fixed at the predetermined intervals and a negative-electrode side heat sink, and two or more rectifying devices attached in each heat sink by soldering etc. While the front side housing 4 and the rear ** housing 5 have contained the rotator 2 and stator 3 which were mentioned above and the rotator 2 is supported in the state which can be rotated focusing on the axis of rotation 24, the stator 3 arranged through a predetermined crevice is being fixed to the outside of the field cores 22 and 23 of a rotator 2. Fixation of this stator 3 is performed by binding tight through a bolt 34 to four supporters 420 formed in the circumferencial direction at equal intervals. About a front side housing 4 detailed configuration, it mentions later.

[0019] Voltage adjustment equipment 8 is for adjusting the output voltage of AC dynamo 1 by controlling the exciting current passed to a field winding 21, and when it is light and a load becomes [output voltage] high, it maintains the output voltage of AC dynamo 1 to a predetermined value by being intermittent in the impression of voltage to a field winding 21. the thing for a pulley 9 telling rotation of an engine (not shown) to the rotator 2 in AC dynamo 1 -- it is -- the axis of rotation 24 -- on the other hand, it is bound tight and fixed to the edge (slip ring 27 grade and opposite side) with the nut 91 Moreover, the rear covering 92 is attached so that brush equipment 6, a rectifier 7, and voltage adjustment equipment 8 may be covered.

[0020] If the rotation from an engine is told to a pulley 9 through a belt etc., a rotator 2 will rotate AC dynamo 1 which has the structure mentioned above in the predetermined direction. By impressing energizing voltage to a field winding 21 from the exterior, each claw part of field cores 22 and 23 is excited, a stator winding 32 can be made to generate three-phase-circuit alternating voltage, and a predetermined direct current is taken out from the output terminal of a rectifier 7. Henceforth, since the output voltage of AC-dynamo 1 self is impressed to a field winding 21 through voltage adjustment equipment 8, the energizing voltage impressed from the outside becomes unnecessary.

[0021] Moreover, since the cooling fan 25 attached in the end face of one field core 22 rotates with rotation of the rotator 2 mentioned above, while a cooling wind is inhaled to the AC-dynamo 1 interior through the inhalation aperture 440 of the front side housing 4 prepared in the pulley 9 side and a field winding 21 is cooled by this shaft-orientations component of the cooling style, the front edge of a stator winding 32 is cooled by the direction component of a path. Since even a cooling fan 26 is led through the inhalation aperture of the rear ** housing 5 and this cooling wind is discharged in the direction of a path after the cooling wind inhaled through the inhalation aperture of the rear covering 92 cools a rectifier 7 or voltage adjustment equipment 8, since similarly the cooling fan 26 attached in the end face of the field core 23 of another side also rotates, the back edge of a stator winding 32 is cooled.

[0022] Drawing 3 extracts only the front side housing 4, and shows the front view. The front side

housing 4 has the bearing box 400 which contains bearing 36 in the position which counters a pulley 9, two stay 410 and 412 used in order to attach AC dynamo 1 at a cylinder crank case (not shown), and four supporters 420 which are near [each] the root portion of such stay 410 and 412, and have been arranged at equal intervals at the side. It is in the state which each supporter 420 has the bolt stowage where the female screw slot was formed in inner skin, and contained the stator 3 in the front side housing 4, and a stator 3 is fixed to the front side housing 4 by binding tight through a bolt 34 to the bolt stowage of each supporter 420.

[0023] Moreover, the four main spokes 430 prolonged in the direction of a path so that the front side housing 4 might connect each of four supporters 420, and the peripheral face of the bearing box 400, Four auxiliary spokes 432 which the two main spokes 430 which adjoin a circumferencial direction are centers mostly, and were prolonged in the direction of a path, It has a total of eight skew spokes 434 formed in the sense which is between the main spokes 430 and the auxiliary spokes 432 which adjoin a circumferencial direction, and has the predetermined degree alpha of tilt angle to the direction of a path. The space divided by these main spokes 430, the auxiliary spoke 432, and the skew spoke 434 is used as an inhalation aperture 440 of the cooling style.

[0024] Drawing 4 is an about 440 inhalation aperture enlarged view. As shown in this drawing, the skew spoke 434 is formed so that it may become the degree alpha of tilt angle to the direction of a path at the inhalation aperture of the about 4 square shape configuration divided as two sides which counter the auxiliary spoke 432 which adjoins the main spoke 430 and this. However, it is necessary to make it this inclination direction become the inclination direction of cooling-fan 25 near point and the contrary close to this skew spoke 434. When its attention is paid to the portion which a cooling fan 25 and the skew spoke 434 counter, the degree beta of tilt angle is set up so that it may retreat to a hand of cut as the inclination direction of cooling-fan 25 point goes to a periphery side. On the other hand, the degree alpha of tilt angle is set up so that it may move forward to a hand of cut, namely, so that it may become the inclination direction of cooling-fan 25 point, and reversely across the direction of a path as the inclination direction of the skew spoke 434 goes to a periphery side.

[0025] Moreover, as for the degree alpha of tilt angle of the skew spoke 434, it is desirable to set up so that it may be contained in the range of 25 degrees - 65 degrees. Although it is more desirable to cross a part for cooling-fan 25 point mostly at a right angle, a big bias arises in each area of inhalation aperture 440B inserted by inhalation aperture 440A and the skew spoke 434 which were pinched by the skew spoke 434 and the main spoke 430, and the auxiliary spoke 432, and the skew spoke 434 is not desirable from increase of inhalation resistance, or the point of foreign matter mixing, if the degree alpha of tilt angle of the skew spoke 434 is set up extremely small or greatly.

[0026] Moreover, when its attention is paid to intensity, as for the skew spoke 434, it is desirable to form so that the peripheral face 450 of the bearing box 400 and the hoop-direction wall surface 452 which counters this peripheral face 450 may be connected. And as mentioned above, in order to lessen the bias of the area of the inhalation apertures 440A and 440B as much as possible, it is desirable to form the skew spoke 434 so that the diagonal line of the inhalation aperture of the about 4 square shape configuration divided as two sides which counter the auxiliary spoke 432 which adjoins the main spoke 430 and this may be met. By forming the skew spoke 434 in such a position, the rigidity of the front side housing 4 whole can be raised. In addition, when sufficient rigidity for the front side housing 4 can be given by the main spoke 430 and the auxiliary spoke 432, you may make it form the skew spoke 434 so that a position may be intersected as [of the skew spoke 434] an edge is the main spoke 430 or the auxiliary spoke 432 on the other hand.

[0027] Moreover, drawing 5 is the V-V line cross section of drawing 4 . As shown in drawing 5 , the main spoke 430, the auxiliary spoke 432, and the skew spoke 434 are set up so that the inner skin of the front side housing 4 may turn into the same side mostly. Inhalation resistance of the cooling style can be lessened by bringing the inner skin of each spoke close to a part for the point of a cooling fan 25. Moreover, each shaft-orientations height of the main spoke 430, the auxiliary spoke 432, and the skew spoke 434 is set up so that it may become low in order of the main spoke 430, the auxiliary spoke 432, and the skew spoke 434. Although it is most effective to increase the cross section of the main spoke

430 in order to raise the rigidity of the front side housing 4, it also takes into consideration securing the area of the inhalation apertures 440A and 440B, and the shaft-orientations height of the main spoke 430 is set up most highly. Moreover, since it is increasing the cross section of the auxiliary spoke 432, one effective in a degree in order to raise the rigidity of the front side housing 4 is set up so that the shaft-orientations height of the auxiliary spoke 432 may become high at the degree of the main spoke 430. Therefore, the shaft-orientations height of the skew spoke 434 is set up so that it may become the lowest. Thus, when the degree of the contribution to a rigid rise sets up the height of a few spoke low, the draft resistance of the cooling style as possible can be reduced.

[0028] As mentioned above, AC dynamo 1 of this operation gestalt is equipped with the rotator 2 by which the cooling fan 25 was attached in the end face of a field core 22, and the skew spoke 434 is formed in the inhalation aperture 440 of the front side housing 4 which supports this rotator 2 possible [rotation]. Since the skew spoke 430 which has the predetermined degree of tilt angle to the direction of a path is formed, when a cooling fan 25 rotates with a rotator 2, area with which a part for a point and the skew spoke 434 of a cooling fan 25 lap simultaneously can be lessened, and the pressure fluctuation produced by rotation of a cooling fan 25 can be reduced.

[0029] Drawing 6 is drawing showing the pressure fluctuation at the time of using a skew spoke. In this drawing, the position which met the hand of cut at the time of rotating a cooling fan 25 is shown, "A" and "C" correspond to the position in which the skew spoke 434 was formed, and the horizontal axis corresponds to the position in which the auxiliary spoke 432 in the meantime was formed for "B." Moreover, the vertical axis shows the pressure near the point part of a cooling fan 25. In addition, while the solid line showed the pressure fluctuation at the time of using the front side housing 4 of this operation gestalt in which the skew spoke 434 was formed, the dotted line showed the pressure fluctuation at the time of using front side housing of the conventional type which transposed the skew spoke 434 of this operation gestalt to the auxiliary spoke 432 for comparison.

[0030] When the amount of [the skew spoke 434 and / of a cooling fan 25] point laps, since these cross with a predetermined angle, the area of a duplication portion becomes small, and elevation of a momentary pressure can be suppressed. However, since it will reach far and wide and a part for a point and the skew spoke 434 of a cooling fan 25 will cross compared with the case where the auxiliary spoke 432 is used instead of the skew spoke 434, the range to which a pressure becomes high becomes large.

[0031] Thus, while being able to stop the pressure fluctuation at the time of rotating a cooling fan 25 by using the front side housing 4 with which the skew spoke 434 was formed, the pressure in the position of the skew spoke 434 and the pressure in the position of the main spoke 430 or the auxiliary spoke 432 are changed, uneven-ization of pressure fluctuation is attained, the degree component of the fan noise made with a cooling fan 25 can be lowered, and low noise-ization of fan noise can be attained.

[0032] Drawing 7 is drawing showing the result which measured the fan noise of AC dynamo 1 of this operation gestalt which used the skew spoke. In this drawing, the horizontal axis shows the fan noise as which the vertical axis expressed the AC-dynamo rotational frequency per dB, respectively. Measurement followed each of "degree envelopment" which shows the envelope of the "overalls" containing all degree components, and each degree component. In addition, while the solid line showed the measurement result at the time of using the front side housing 4 of this operation gestalt in which the skew spoke 434 was formed, the dotted line showed the measurement result at the time of using front side housing of the conventional type which transposed the skew spoke 434 to the auxiliary spoke 432 for comparison.

[0033] As shown in drawing 7 , the effect of a fan noise reduction was checked in the comparatively high rotational frequency. Especially about "degree envelopment", reduction of a large fan noise was realized in the predetermined range of a high rotation region. Since this has arranged the skew spoke 434 between the main spoke 430 or the auxiliary spoke 432, pressure fluctuation ununiformity-izes it, and it is considered to be because for the degree component to have been distributed.

[0034] By the way, although the skew spoke 434 mentioned above is formed in the shape of a straight line so that it may have the fixed degree alpha of tilt angle to the direction of a path, it changes the inclination direction on the way, and you may make it form it in the "character" type of **. Drawing 8 is

drawing showing the modification which formed the skew spoke in the character type of **. It differs in that the configuration of a skew spoke was changed to the front side housing 4 which showed front side housing 4A shown in this drawing to drawing 3 . Two steps of the degrees of tilt angle over the direction of a path are set up, and by making inhalation-of-air aperture 440C which adjoins the side which retreats to the hand of cut of a stator project, skew spoke 434A is set up so that the area of two inhalation-of-air apertures 440C and 440D which adjoin this skew spoke 434A may become almost the same.

[0035] Thus, by setting the inclination direction of skew spoke 434A as two stages, and using the configuration as the character type of **, the bias of the area of the inhalation apertures 440C and 440D can be abolished, and reduction of inhalation resistance can be aimed at compared with the case where one area becomes extremely small. Moreover, since the size of the foreign matter which can invade becomes small by equalizing the area of the inhalation apertures 440C and 440D, the exclusion capacity of a foreign matter can be heightened.

[0036] Moreover, the skew spokes 434 and 434A mentioned above have a predetermined angle to the direction of a path, and although it was formed so that it might become parallel to the axis of rotation 24 about shaft orientations, you may make it attach an inclination also about shaft orientations. Drawing 9 is drawing showing the modification which made the skew spoke incline to shaft orientations, and the partial enlarged view near the skew spoke is shown. Moreover, drawing 10 is the X-X line cross section of drawing 9 .

[0037] As shown in drawing 9 and drawing 10 , skew spoke 434B inclines in the sense which retreats to a hand of cut as it is carrying out the predetermined angle inclination to shaft orientations and keeps away from an opposed face with a cooling fan 25. It is known that the cooling wind generally inhaled when rotating a rotator 2 will flow to the inclination direction and the same direction of this skew spoke 434B. That is, by deciding the inclination direction to the shaft orientations of skew spoke 434B according to the inhalation direction of the cooling style, increase of the inhalation resistance by skew spoke 434B existing can be reduced as much as possible, and cooling performance degradation can be prevented.

[0038] In addition, this invention is not limited to the above-mentioned operation gestalt, and deformation implementation various by within the limits of the summary of this invention is possible for it. For example, although skew spoke 434A contained in front side housing 4A shown in drawing 8 was bent once on the way and formed in the character type of **, it may bend twice or more or you may make it form the whole in a smooth curve configuration. Moreover, although only skew spoke 434B was made to incline to shaft orientations with front side housing shown partially in drawing 9 , you may make it incline to shaft orientations similarly about the main spoke 430 or the auxiliary spoke 432.

[0039] Moreover, although the cooling fan 25, the portion which counters, and this and the portion which approaches a pulley 9 side reversely are formed at the almost same configuration, since it is the configuration of the portion which counters a cooling fan 25 etc., one especially required in order to reduce fan noise can change suitably the skew spokes 434, 434A, and 434B contained in front side housing of each operation gestalt mentioned above about the configuration of the other portion. For example, you may make it twist skew spoke 434 grade in accordance with shaft orientations so that it may approach in the direction of a path as a pulley 9 side is approached.

[0040] Moreover, although each operation gestalt mentioned above explained the case where a skew spoke was formed in the inhalation-of-air aperture of the front side housing 4, this invention can be applied when forming a spoke in the inhalation-of-air aperture of the rear ** housing 5.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the AC generator for vehicles having a cooling fan.

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PRIOR ART

[Description of the Prior Art] The AC generator for vehicles which is a kind of rotation electrical machinery provides the power of ignition in an engine, lighting, and other various electronic autoparts while performing the supplementary current of a battery during a vehicles run. In recent years, low noise-ization of the AC generator for vehicles is demanded with upgrading of vehicles etc.
[0003] By the way, there is fan noise generated when one of the noise of the AC generator for vehicles is made to rotate a cooling fan. In the AC generator for vehicles of an inner fan type with which the cooling fan was fixed to the shaft-orientations end face of a rotator It is known that fan noise will occur [near / where this rotator is contained / the inhalation aperture of a frame], and there is an AC generator for vehicles indicated by the charging generator for vehicles indicated by JP,3-21964,U and JP,7-107704,A as conventional technology of reducing the fan noise made in this portion.
[0004] The configuration of an inhalation aperture where the charging generator for vehicles indicated by JP,3-21964,U was formed in front side housing (bracket) is asymmetrically set up to the center of housing. For this reason, even if it is the case where the fan attached in the shaft-orientations end face of a rotator rotates, it is hard to produce the periodic pressure fluctuation of inhalation of air, consequently generating of a rotation degree ratio component is decreased, the frequency which constitutes the fan noise resulting from inhalation of air can be distributed widely, the jarring feeling of a wind noise can be reduced, and, moreover, the overalls value of fan noise can also be reduced.
[0005] Moreover, as for the AC generator for vehicles indicated by JP,7-107704,A, the outline configuration of the inhalation aperture of front side housing is formed in the square configuration or the polygon configuration. For this reason, the degree component of fan noise is distributed and a fan noise reduction and unpleasant sound reduction can be aimed at.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, since the configuration of the inhalation aperture of front side housing is asymmetrically set up to the center of a frame, the charging generator for vehicles indicated by JP,3-21964,U mentioned above has the problem that the configuration of an inhalation aperture becomes complicated, and the die design for manufacturing a product design and this becomes complicated, and becomes cost quantity.
[0007] Moreover, since the AC generator for vehicles indicated by JP,7-107704,A mentioned above formed the outline configuration of the inhalation aperture of front side housing in a polygon, when forming circularly, the area of the whole inhalation aperture became small, and it had the problem that air capacity decreased and a cooling performance fell. Thus, in order to reduce fan noise, the configuration of an inhalation aperture became complicated, or air capacity decreased, the cooling performance was falling, and the conventional AC generator for vehicles mentioned above was not able to say it as a fundamental solution.
[0008] It is created in view of such a point, and the purpose has the simple configuration of the inhalation aperture of the cooling style, and this invention has it in offering the AC generator for vehicles in which the reduction in noise is possible, without moreover reducing a cooling performance.

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MEANS

[Means for Solving the Problem] In order to solve the technical problem mentioned above, the skew spoke which has the sense toward which the AC generator for vehicles of this invention inclined to the direction of a path in the inhalation aperture of the cooling style of housing is formed. The pressure fluctuation produced when a cooling fan rotates and it laps with this skew spoke by using this housing for a field core end face combining the rotator attached in the cooling fan, and it prevents that duplication area increases rapidly temporarily and a cooling fan rotates can be reduced, and low noise-ization can be attained. Moreover, since the direction of the spoke formed in the inhalation aperture of housing was made to only incline to the direction of a path, the configuration of the whole inhalation aperture is simple and a design and manufacture become easy. Moreover, in order that the area of an inhalation aperture may not decrease, cooling nature does not fall.
[0010] As for especially the inclination direction of the skew spoke mentioned above, it is desirable to set up so that it may become the inclination direction of a cooling fan and reversely to the direction of a path. By setting the sense of a cooling fan and a skew spoke as the reverse sense mutually, the pressure fluctuation produced when duplication area can be lessened and a cooling fan rotates, since each opposite portion of a cooling fan and a skew spoke will cross at a perpendicularly near angle can be reduced further.
[0011] Moreover, the direction spoke of a path which met in the direction of a path other than a skew spoke is formed in housing mentioned above, and it is desirable to arrange a skew spoke between the direction spokes of a path which adjoin a circumferencial direction (hand of cut). Since the intensity (rigidity) of housing can be raised and the direction spoke of a path and a skew spoke will moreover be arranged by turns by using combining the direction spoke of a path, pressure fluctuation produced between cooling fans and these spokes is ununiformity-ized, the degree component of fan noise is distributed, and the further low noise-ization is attained.
[0012] Moreover, it is desirable to deal with the supporter along which the bolt for stator conclusion passes to a part of direction spoke [at least] of a path mentioned above. By lessening distortion of housing generated at the time of bolting of a bolt, at the time of power generation, a magnetic noise generated in very small vibration of a stator can be reduced, and generating of the noise in the whole AC generator for vehicles can be suppressed further.
[0013] Moreover, when using combining the direction spoke of a path, and a skew spoke, as for a skew spoke, it is desirable to form along with the diagonal line of the inhalation aperture divided by the direction spoke of a path. By forming along with the diagonal line, the degree of an inclination can be set up greatly, the angle which a cooling fan and a skew spoke intersect can be enlarged further, and the pressure fluctuation produced at the time of cooling-fan rotation can be reduced further. Moreover, since a skew spoke will be formed so that an inner circumference [of an inhalation aperture] and periphery side may be connected, a certain amount of intensity is securable with a skew spoke. For this reason, the rigidity of housing can go up and a magnetic noise made by very small vibration of a stator can be reduced.
[0014]

[Embodiments of the Invention] The AC generator for vehicles of 1 operation gestalt which applied this invention (a "AC dynamo" is called henceforth) has the feature in having formed the skew spoke which inclined in the reverse sense with the cooling fan attached in the rotator at the inhalation aperture of the cooling style prepared in housing. Hereafter, the AC dynamo of 1 operation gestalt which applied this invention is explained concretely, referring to a drawing.

[0015] Drawing 1 is the cross section showing the whole AC-dynamo structure of this operation gestalt. Moreover, drawing 2 is the front view of the AC dynamo of this operation gestalt seen from the front side. As shown in these drawings, AC dynamo 1 is constituted including a rotator 2, a stator 3, the front side housing 4, the rear ** housing 5, brush equipment 6, a rectifier 7, voltage adjustment equipment 8, and the pulley 9.

[0016] The rotator 2 has the structure between which each put the field winding 21 which coiled about the copper wire by which insulating processing was carried out the shape of a cylinder, and in the shape of the said heart from both sides through the axis of rotation 24 by the field cores 22 and 23 which have six claw parts. Moreover, in order to breathe out the cooling wind absorbed from the front side in shaft orientations and the direction of a path, the cooling fan 25 of an axial flow formula is being attached and fixed to the end face of the field core 22 by the side of a front (pulley 9 side) by welding etc. Similarly, in order to breathe out the cooling wind absorbed from rear ** in the direction of a path, the cooling fan 26 of a centrifugal type is attached in the end face of the magnetic pole iron core 23 of rear ** by welding etc.

[0017] Moreover, the slip rings 27 and 28 connected electrically are formed in the ends of a field winding 21 at rear ** of the axis of rotation 24, and an exciting current flows from a rectifier 7 to a field winding 21 by attaching, where the brushes 61 and 62 in brush equipment 6 are pressed against each of the slip rings 27 and 28. A stator 3 is wound about around two or more slots formed in the stator core 31 an interval predetermined in the stator winding 32 of a three phase circuit.

[0018] A rectifier 7 is for rectifying the three-phase-circuit alternating current which is the output voltage of the stator winding 32 of a three phase circuit, and obtaining dc output, and is constituted including the positive-electrode side heat sink fixed at the predetermined intervals and a negative-electrode side heat sink, and two or more rectifying devices attached in each heat sink by soldering etc. While the front side housing 4 and the rear ** housing 5 have contained the rotator 2 and stator 3 which were mentioned above and the rotator 2 is supported in the state which can be rotated focusing on the axis of rotation 24, the stator 3 arranged through a predetermined crevice is being fixed to the outside of the field cores 22 and 23 of a rotator 2. Fixation of this stator 3 is performed by binding tight through a bolt 34 to four supporters 420 formed in the circumferencial direction at equal intervals. About a front side housing 4 detailed configuration, it mentions later.

[0019] Voltage adjustment equipment 8 is for adjusting the output voltage of AC dynamo 1 by controlling the exciting current passed to a field winding 21, and when it is light and a load becomes [output voltage] high, it maintains the output voltage of AC dynamo 1 to a predetermined value by being intermittent in the impression of voltage to a field winding 21. the thing for a pulley 9 telling rotation of an engine (not shown) to the rotator 2 in AC dynamo 1 -- it is -- the axis of rotation 24 -- on the other hand, it is bound tight and fixed to the edge (slip ring 27 grade and opposite side) with the nut 91 Moreover, the rear covering 92 is attached so that brush equipment 6, a rectifier 7, and voltage adjustment equipment 8 may be covered.

[0020] If the rotation from an engine is told to a pulley 9 through a belt etc., a rotator 2 will rotate AC dynamo 1 which has the structure mentioned above in the predetermined direction. By impressing energizing voltage to a field winding 21 from the exterior, each claw part of field cores 22 and 23 is excited, a stator winding 32 can be made to generate three-phase-circuit alternating voltage, and a predetermined direct current is taken out from the output terminal of a rectifier 7. Henceforth, since the output voltage of AC-dynamo 1 self is impressed to a field winding 21 through voltage adjustment equipment 8, the energizing voltage impressed from the outside becomes unnecessary.

[0021] Moreover, since the cooling fan 25 attached in the end face of one field core 22 rotates with rotation of the rotator 2 mentioned above, while a cooling wind is inhaled to the AC-dynamo 1 interior

through the inhalation aperture 440 of the front side housing 4 prepared in the pulley 9 side and a field winding 21 is cooled by this shaft-orientations component of the cooling style, the front edge of a stator winding 32 is cooled by the direction component of a path. Since even a cooling fan 26 is led through the inhalation aperture of the rear ** housing 5 and this cooling wind is discharged in the direction of a path after the cooling wind inhaled through the inhalation aperture of the rear covering 92 cools a rectifier 7 or voltage adjustment equipment 8, since similarly the cooling fan 26 attached in the end face of the field core 23 of another side also rotates, the back edge of a stator winding 32 is cooled.

[0022] Drawing 3 extracts only the front side housing 4, and shows the front view. The front side housing 4 has the bearing box 400 which contains bearing 36 in the position which counters a pulley 9, two stay 410 and 412 used in order to attach AC dynamo 1 at a cylinder crank case (not shown), and four supporters 420 which are near [each] the root portion of such stay 410 and 412, and have been arranged at equal intervals at the side. It is in the state which each supporter 420 has the bolt stowage where the female screw slot was formed in inner skin, and contained the stator 3 in the front side housing 4, and a stator 3 is fixed to the front side housing 4 by binding tight through a bolt 34 to the bolt stowage of each supporter 420.

[0023] Moreover, the four main spokes 430 prolonged in the direction of a path so that the front side housing 4 might connect each of four supporters 420, and the peripheral face of the bearing box 400, Four auxiliary spokes 432 which the two main spokes 430 which adjoin a circumferencial direction are centers mostly, and were prolonged in the direction of a path, It has a total of eight skew spokes 434 formed in the sense which is between the main spokes 430 and the auxiliary spokes 432 which adjoin a circumferencial direction, and has the predetermined degree alpha of tilt angle to the direction of a path. The space divided by these main spokes 430, the auxiliary spoke 432, and the skew spoke 434 is used as an inhalation aperture 440 of the cooling style.

[0024] Drawing 4 is an about 440 inhalation aperture enlarged view. As shown in this drawing, the skew spoke 434 is formed so that it may become the degree alpha of tilt angle to the direction of a path at the inhalation aperture of the about 4 square shape configuration divided as two sides which counter the auxiliary spoke 432 which adjoins the main spoke 430 and this. However, it is necessary to make it this inclination direction become the inclination direction of cooling-fan 25 near point and the contrary close to this skew spoke 434. When its attention is paid to the portion which a cooling fan 25 and the skew spoke 434 counter, the degree beta of tilt angle is set up so that it may retreat to a hand of cut as the inclination direction of cooling-fan 25 point goes to a periphery side. On the other hand, the degree alpha of tilt angle is set up so that it may move forward to a hand of cut, namely, so that it may become the inclination direction of cooling-fan 25 point, and reversely across the direction of a path as the inclination direction of the skew spoke 434 goes to a periphery side.

[0025] Moreover, as for the degree alpha of tilt angle of the skew spoke 434, it is desirable to set up so that it may be contained in the range of 25 degrees - 65 degrees. Although it is more desirable to cross a part for cooling-fan 25 point mostly at a right angle, a big bias arises in each area of inhalation aperture 440B inserted by inhalation aperture 440A and the skew spoke 434 which were pinched by the skew spoke 434 and the main spoke 430, and the auxiliary spoke 432, and the skew spoke 434 is not desirable from increase of inhalation resistance, or the point of foreign matter mixing, if the degree alpha of tilt angle of the skew spoke 434 is set up extremely small or greatly.

[0026] Moreover, when its attention is paid to intensity, as for the skew spoke 434, it is desirable to form so that the peripheral face 450 of the bearing box 400 and the hoop-direction wall surface 452 which counters this peripheral face 450 may be connected. And as mentioned above, in order to lessen the bias of the area of the inhalation apertures 440A and 440B as much as possible, it is desirable to form the skew spoke 434 so that the diagonal line of the inhalation aperture of the about 4 square shape configuration divided as two sides which counter the auxiliary spoke 432 which adjoins the main spoke 430 and this may be met. By forming the skew spoke 434 in such a position, the rigidity of the front side housing 4 whole can be raised. In addition, when sufficient rigidity for the front side housing 4 can be given by the main spoke 430 and the auxiliary spoke 432, you may make it form the skew spoke 434 so that a position may be intersected as [of the skew spoke 434] an edge is the main spoke 430 or the

auxiliary spoke 432 on the other hand.
[0027] Moreover, drawing 5 is the V-V line cross section of drawing 4 . As shown in drawing 5 , the main spoke 430, the auxiliary spoke 432, and the skew spoke 434 are set up so that the inner skin of the front side housing 4 may turn into the same side mostly. Inhalation resistance of the cooling style can be lessened by bringing the inner skin of each spoke close to a part for the point of a cooling fan 25. Moreover, each shaft-orientations height of the main spoke 430, the auxiliary spoke 432, and the skew spoke 434 is set up so that it may become low in order of the main spoke 430, the auxiliary spoke 432, and the skew spoke 434. Although it is most effective to increase the cross section of the main spoke 430 in order to raise the rigidity of the front side housing 4, it also takes into consideration securing the area of the inhalation apertures 440A and 440B, and the shaft-orientations height of the main spoke 430 is set up most highly. Moreover, since it is increasing the cross section of the auxiliary spoke 432, one effective in a degree in order to raise the rigidity of the front side housing 4 is set up so that the shaft-orientations height of the auxiliary spoke 432 may become high at the degree of the main spoke 430. Therefore, the shaft-orientations height of the skew spoke 434 is set up so that it may become the lowest. Thus, when the degree of the contribution to a rigid rise sets up the height of a few spoke low, the draft resistance of the cooling style as possible can be reduced.
[0028] As mentioned above, AC dynamo 1 of this operation gestalt is equipped with the rotator 2 by which the cooling fan 25 was attached in the end face of a field core 22, and the skew spoke 434 is formed in the inhalation aperture 440 of the front side housing 4 which supports this rotator 2 possible [rotation]. Since the skew spoke 430 which has the predetermined degree of tilt angle to the direction of a path is formed, when a cooling fan 25 rotates with a rotator 2, area with which a part for a point and the skew spoke 434 of a cooling fan 25 lap simultaneously can be lessened, and the pressure fluctuation produced by rotation of a cooling fan 25 can be reduced.
[0029] Drawing 6 is drawing showing the pressure fluctuation at the time of using a skew spoke. In this drawing, the position which met the hand of cut at the time of rotating a cooling fan 25 is shown, "A" and "C" correspond to the position in which the skew spoke 434 was formed, and the horizontal axis corresponds to the position in which the auxiliary spoke 432 in the meantime was formed for "B." Moreover, the vertical axis shows the pressure near the point part of a cooling fan 25. In addition, while the solid line showed the pressure fluctuation at the time of using the front side housing 4 of this operation gestalt in which the skew spoke 434 was formed, the dotted line showed the pressure fluctuation at the time of using front side housing of the conventional type which transposed the skew spoke 434 of this operation gestalt to the auxiliary spoke 432 for comparison.
[0030] When the amount of [the skew spoke 434 and / of a cooling fan 25] point laps, since these cross with a predetermined angle, the area of a duplication portion becomes small, and elevation of a momentary pressure can be suppressed. However, since it will reach far and wide and a part for a point and the skew spoke 434 of a cooling fan 25 will cross compared with the case where the auxiliary spoke 432 is used instead of the skew spoke 434, the range to which a pressure becomes high becomes large.
[0031] Thus, while being able to stop the pressure fluctuation at the time of rotating a cooling fan 25 by using the front side housing 4 with which the skew spoke 434 was formed, the pressure in the position of the skew spoke 434 and the pressure in the position of the main spoke 430 or the auxiliary spoke 432 are changed, uneven-ization of pressure fluctuation is attained, the degree component of the fan noise made with a cooling fan 25 can be lowered, and low noise-ization of fan noise can be attained.
[0032] Drawing 7 is drawing showing the result which measured the fan noise of AC dynamo 1 of this operation gestalt which used the skew spoke. In this drawing, the horizontal axis shows the fan noise as which the vertical axis expressed the AC-dynamo rotational frequency per dB, respectively. Measurement followed each of "degree envelopment" which shows the envelope of the "overalls" containing all degree components, and each degree component. In addition, while the solid line showed the measurement result at the time of using the front side housing 4 of this operation gestalt in which the skew spoke 434 was formed, the dotted line showed the measurement result at the time of using front side housing of the conventional type which transposed the skew spoke 434 to the auxiliary spoke 432 for comparison.

[0033] As shown in drawing 7 , the effect of a fan noise reduction was checked in the comparatively high rotational frequency. Especially about "degree envelopment", reduction of a large fan noise was realized in the predetermined range of a high rotation region. Since this has arranged the skew spoke 434 between the main spoke 430 or the auxiliary spoke 432, pressure fluctuation ununiformity-izes it, and it is considered to be because for the degree component to have been distributed.
[0034] By the way, although the skew spoke 434 mentioned above is formed in the shape of a straight line so that it may have the fixed degree alpha of tilt angle to the direction of a path, it changes the inclination direction on the way, and you may make it form it in the "character" type of **. Drawing 8 is drawing showing the modification which formed the skew spoke in the character type of **. It differs in that the configuration of a skew spoke was changed to the front side housing 4 which showed front side housing 4A shown in this drawing to drawing 3 . Two steps of the degrees of tilt angle over the direction of a path are set up, and by making inhalation-of-air aperture 440C which adjoins the side which retreats to the hand of cut of a stator project, skew spoke 434A is set up so that the area of two inhalation-of-air apertures 440C and 440D which adjoin this skew spoke 434A may become almost the same.
[0035] Thus, by setting the inclination direction of skew spoke 434A as two stages, and using the configuration as the character type of **, the bias of the area of the inhalation apertures 440C and 440D can be abolished, and reduction of inhalation resistance can be aimed at compared with the case where one area becomes extremely small. Moreover, since the size of the foreign matter which can invade becomes small by equalizing the area of the inhalation apertures 440C and 440D, the exclusion capacity of a foreign matter can be heightened.
[0036] Moreover, the skew spokes 434 and 434A mentioned above have a predetermined angle to the direction of a path, and although it was formed so that it might become parallel to the axis of rotation 24 about shaft orientations, you may make it attach an inclination also about shaft orientations. Drawing 9 is drawing showing the modification which made the skew spoke incline to shaft orientations, and the partial enlarged view near the skew spoke is shown. Moreover, drawing 10 is the X-X line cross section of drawing 9 .
[0037] As shown in drawing 9 and drawing 10 , skew spoke 434B inclines in the sense which retreats to a hand of cut as it is carrying out the predetermined angle inclination to shaft orientations and keeps away from an opposed face with a cooling fan 25. It is known that the cooling wind generally inhaled when rotating a rotator 2 will flow to the inclination direction and the same direction of this skew spoke 434B. That is, by deciding the inclination direction to the shaft orientations of skew spoke 434B according to the inhalation direction of the cooling style, increase of the inhalation resistance by skew spoke 434B existing can be reduced as much as possible, and cooling performance degradation can be prevented.
[0038] In addition, this invention is not limited to the above-mentioned operation form, and deformation implementation various by within the limits of the summary of this invention is possible for it. For example, although skew spoke 434A contained in front side housing 4A shown in drawing 8 was bent once on the way and formed in the character type of **, it may bend twice or more or you may make it form the whole in a smooth curve configuration. Moreover, although only skew spoke 434B was made to incline to shaft orientations with front side housing shown partially in drawing 9 , you may make it incline to shaft orientations similarly about the main spoke 430 or the auxiliary spoke 432.
[0039] Moreover, although the cooling fan 25, the portion which counters, and this and the portion which approaches a pulley 9 side reversely are formed at the almost same configuration, since it is the configuration of the portion which counters a cooling fan 25 etc., one especially required in order to reduce fan noise can change suitably the skew spokes 434, 434A, and 434B contained in front side housing of each operation form mentioned above about the configuration of the other portion. For example, you may make it twist skew spoke 434 grade in accordance with shaft orientations so that it may approach in the direction of a path as a pulley 9 side is approached.
[0040] Moreover, although each operation form mentioned above explained the case where a skew spoke was formed in the inhalation-of-air aperture of the front side housing 4, this invention can be applied when forming a spoke in the inhalation-of-air aperture of the rear ** housing 5.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section showing the whole AC-dynamo structure of this operation gestalt.
[Drawing 2] It is the front view of the AC dynamo shown in drawing 1 .
[Drawing 3] It is the front view of front side housing.
[Drawing 4] It is an enlarged view near the inhalation aperture of front side housing.
[Drawing 5] It is the V-V line cross section of drawing 4 .
[Drawing 6] It is drawing showing the pressure fluctuation at the time of using a skew spoke.
[Drawing 7] It is drawing showing the measurement result of the fan noise of the AC dynamo with which front side housing which has a skew spoke is contained.
[Drawing 8] It is drawing showing the modification which formed the skew spoke in the character type of **.
[Drawing 9] It is drawing showing the modification which made the skew spoke incline to shaft orientations.
[Drawing 10] It is the X-X line cross section of drawing 9 .
[Description of Notations]
1 AC Dynamo
2 Rotator
3 Stator
4 Front Side Housing
5 Rear ** Housing
22 23 Field core
24 Axis of Rotation
25 26 Cooling fan
430 The Main Spoke
432 Auxiliary Spoke
434 Skew Spoke
440 Inhalation Aperture

[Translation done.]

* NOTICES *

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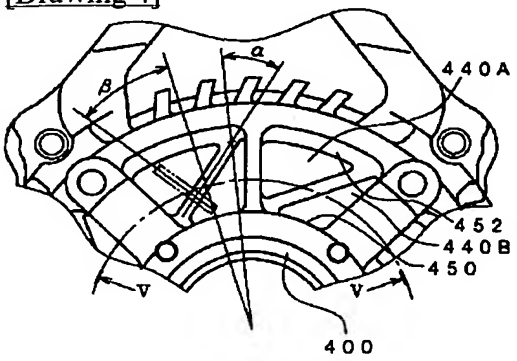
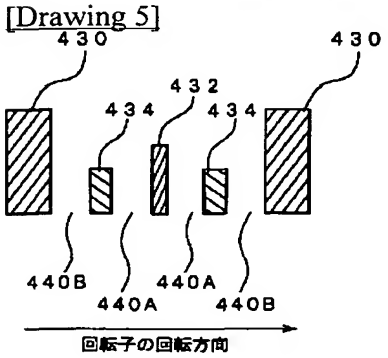
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

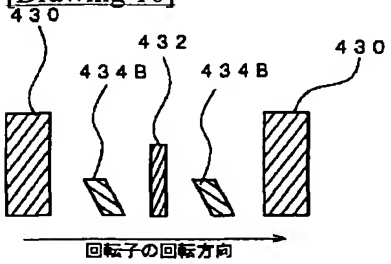
[Drawing 4]



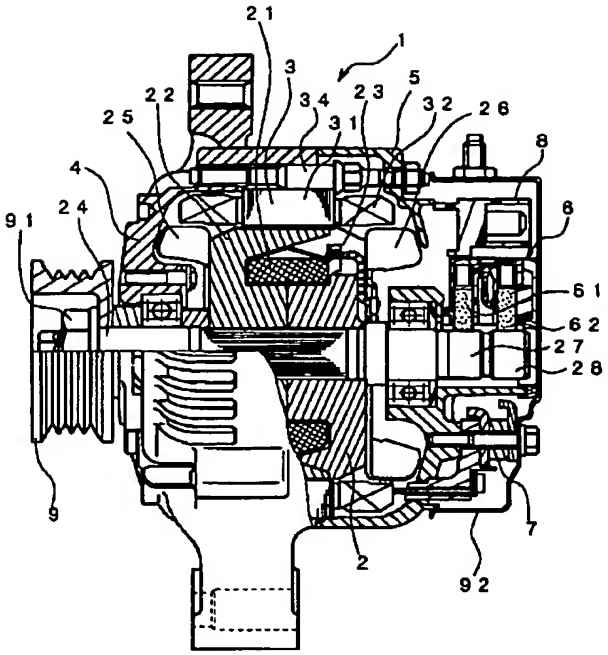
[Drawing 5]



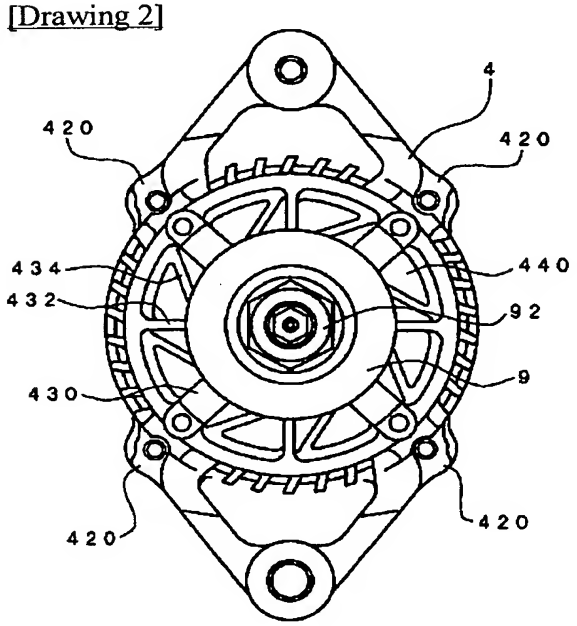
[Drawing 10]



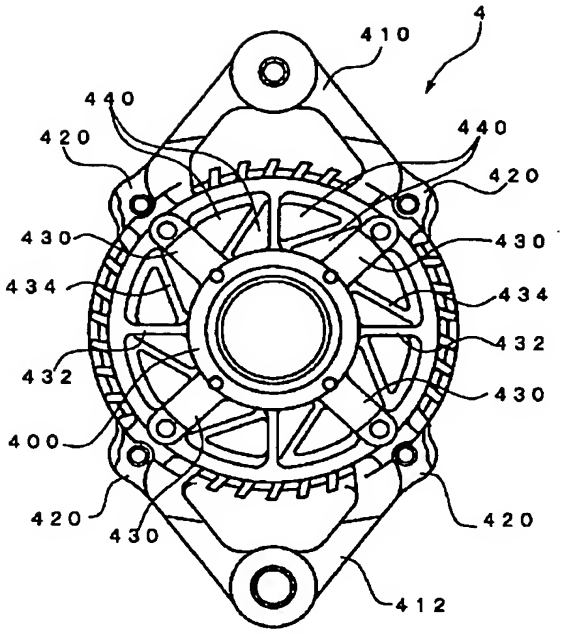
[Drawing 1]



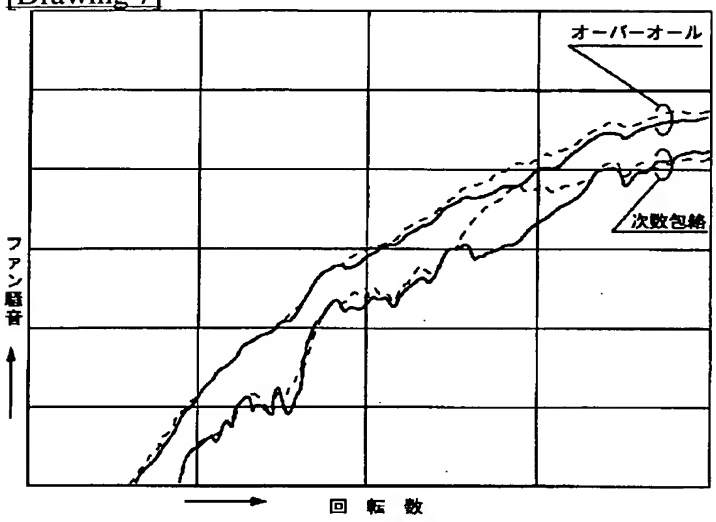
[Drawing 2]



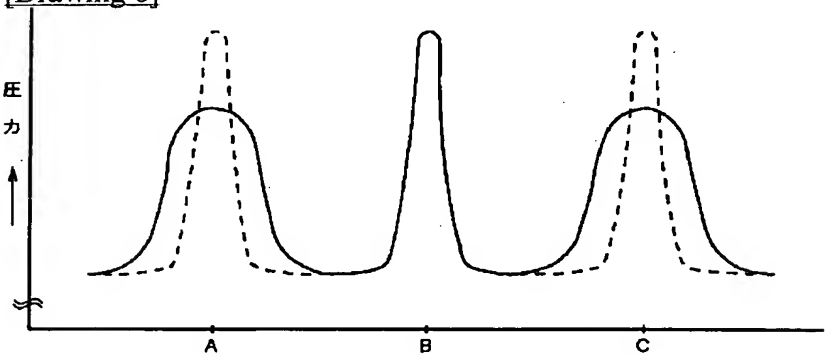
[Drawing 3]



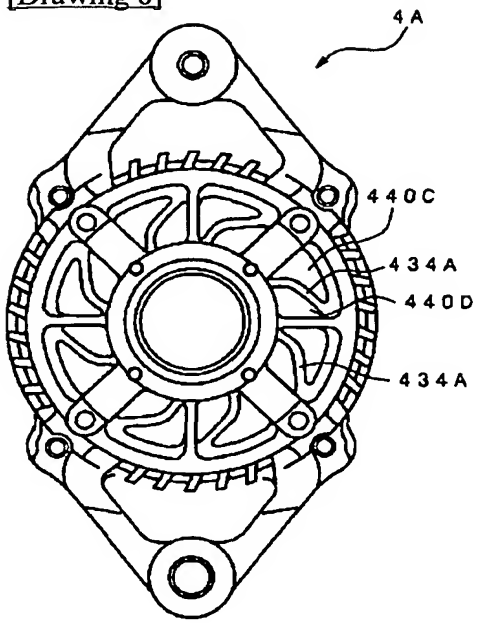
[Drawing 7]



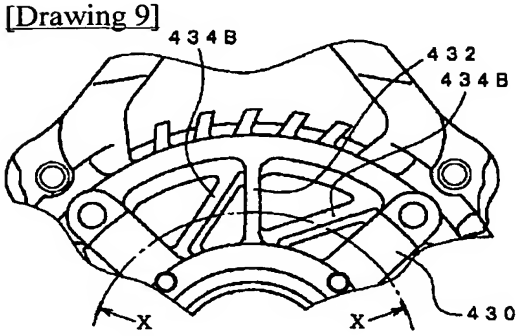
[Drawing 6]



[Drawing 8]



[Drawing 9]



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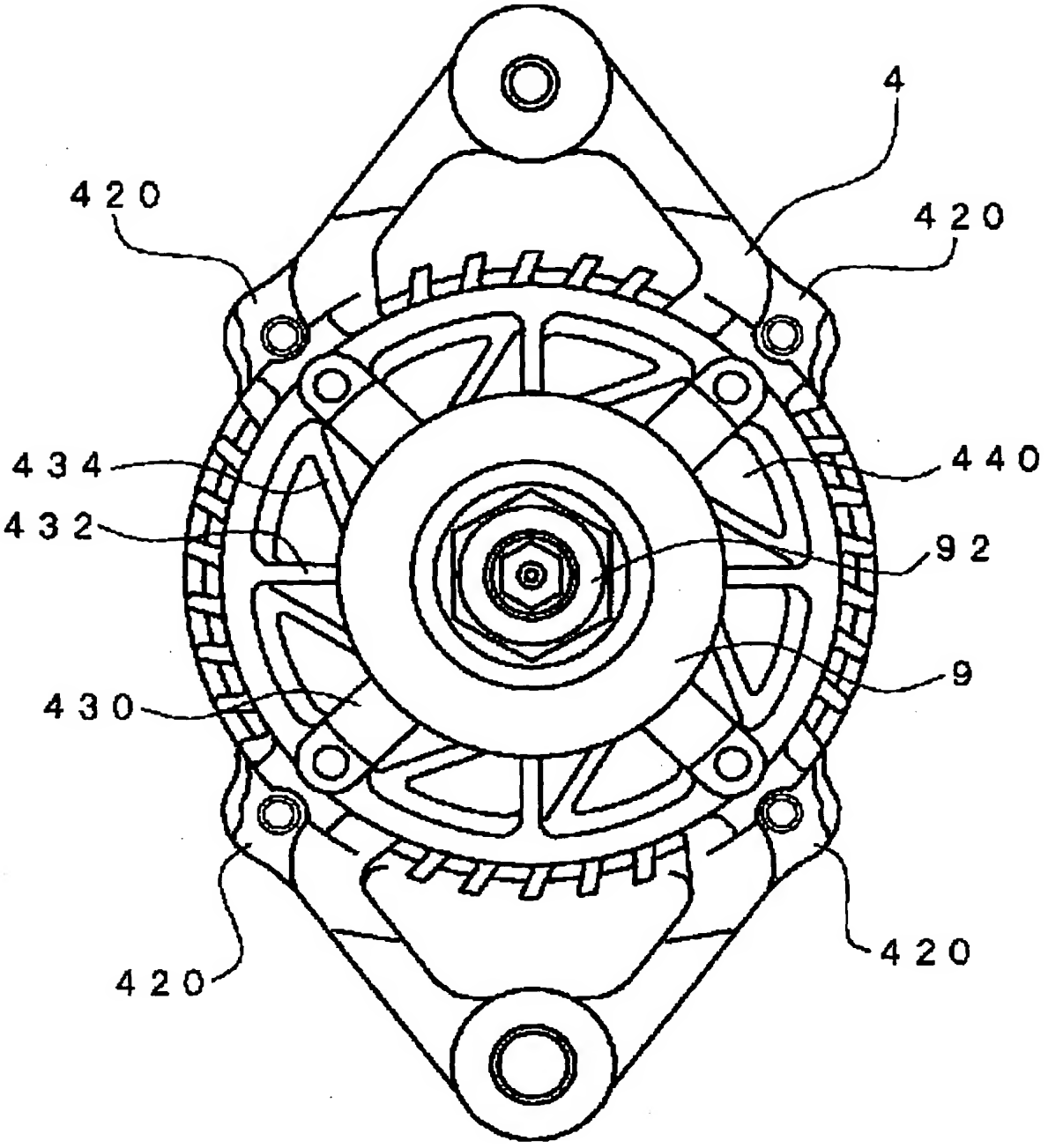
JAPANESE [JP,11-332178,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]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